

We Claim:

1. A placement system for populating a substrate with at least one electronic component of a semiconductor wafer divided into electronic components, the placement system comprising:

a substrate holding device for receiving the substrate;

a wafer holding device disposed above said substrate holding device and adapted to receive a wafer holding frame;

said substrate holding device and said wafer holding device being disposed to be positioned with respect to one another horizontally in an X direction and a Y direction;

a vacuum forceps holding device disposed above said wafer holding device, said vacuum forceps holding device having a vacuum forceps, which can be finely adjusted in the X direction and the Y direction with regard to said substrate holding device and disposed to be rotatable and finely adjustable about a Z axis extending in a Z direction; and

said vacuum forceps holding device being configured to move said vacuum forceps, in a region of said wafer holding frame, vertically in the Z direction into a rest position, into a preliminary position, and into a mounting position.

2. The placement system according to claim 1, wherein said wafer holding frame holds a film formed with passage openings, and a plurality of components of the semiconductor wafer separated into electronic components are disposed at said film with the components respectively arranged under one of said passage openings of said film.

3. The placement system according to claim 2, wherein said wafer holding frame is adapted to a diameter of a semiconductor wafer, and a configuration of said passage openings in said film of said wafer holding frame corresponds to an arrangement of the electronic components of the semiconductor wafer.

4. The placement system according to claim 2, wherein said vacuum forceps of said vacuum forceps holding device is disposed above a respective passage opening in the rest position, and said vacuum forceps, in the preliminary position thereof, is enabled to take up an electronic component of the semiconductor wafer disposed under the respective passage opening in the Z direction, and said vacuum forceps with the electronic component thus taken up, in the mounting position of the vacuum forceps, is finely adjustable and positionable in a predetermined position above the substrate.

5. The placement system according to claim 1, wherein said vacuum forceps holding device has a component position identification device.

6. The placement system according to claim 5, wherein said component position identification device is configured to detect components of the semiconductor wafer that are marked as non-functional.

7. The placement system according to claim 5, wherein said component position identification device has a light pulse transmitter, a receiver, and an evaluation circuit for a position determination in the X direction and the Y direction.

8. The placement system according to claim 5, which further comprises a programmable controller connected to said wafer holding device and configured to cause said wafer holding device to bring one of the electronic components into a defined detection region of said component position identification device, and to cause said substrate holding device to bring the substrate into a predetermined position for mounting an electronic component on a top side of the substrate.

9. The placement system according to claim 1, wherein said placement system has a feed device for supplying substrates to

said substrate holding device and a discharge device for discharging substrates from said substrate holding device.

10. The placement system according to claim 1, wherein said placement system has a feed device for supplying wafer holding frames to said wafer holding device and a discharge device for discharging wafer holding frames from said wafer holding device.

11. A wafer holding frame configured for the placement system according to claim 1, comprising:

a film having a plurality of passage openings formed therein;  
and

a plurality of components of a semiconductor wafer separated into individual electronic components respectively disposed under one of said passage openings of said film.

12. The wafer holding frame according to claim 11, wherein the wafer holding frame has an inner diameter adapted to a diameter of a semiconductor wafer and said passage openings in said film are arranged to correspond to an arrangement of the electronic components of the semiconductor wafer.

13. The wafer holding frame according to claim 11, wherein a diameter of the passage openings is adapted to a diameter of the vacuum forceps such that, the vacuum forceps is enabled, through a respective passage opening, to carry out a fine adjustment in the X direction and in the Y direction and a rotational movement about the Z axis of the electronic component with respect to the predetermined position on the substrate in the mounting position of the vacuum forceps.

14. The wafer holding frame according to claim 11, wherein a diameter of said passage openings is smaller than an area diagonal of the electronic component.

15. The wafer holding frame according to claim 11, wherein said film of the wafer holding frame is a single-side adhesive film.

16. A film for the wafer holding frame according to claim 11, wherein the film is formed with a configuration of passage openings in columns and rows corresponding to columns and rows of electronic components of a semiconductor wafer divided into the electronic components.

17. The film according to claim 16, wherein said passage openings of the film have a smaller diameter than a diagonal of the electronic components.

18. The film according to claim 16, wherein said passage openings in the film are adapted to a diameter of the vacuum forceps to enable the vacuum forceps to execute fine adjustment movements in the X and Y directions within the passage openings.

19. A method for populating a substrate with electronic components, the method which comprises:

providing a wafer holding frame with a perforated film clamped in the wafer holding frame and formed with passage openings arranged in individual rows and columns, and a plurality of electronic components of a semiconductor wafer separated into electronic components disposed under the passage openings of the film;

providing a substrate with predetermined positions for placement of the electronic components;

supplying the wafer holding frame into a positioning wafer holding device and supplying the substrate into a positioning substrate holding device and horizontally orienting the positioning wafer holding device and the positioning substrate holding device in an X direction and a Y direction relative to one another in a predetermined position for positioning a

respective electronic component of the electronic components of the semiconductor wafer on the substrate;

moving a vacuum forceps with a vacuum forceps holding device, while monitoring with a component position identification device, from a rest position vertically in a Z direction through a respective passage opening of the film while carrying along the electronic component, from a preliminary position, and carrying the electronic component into a mounting position on the substrate with rotation about the Z axis and fine adjustment of the vacuum forceps in the X direction and the Y direction.

20. The method according to claim 19, which comprises heating the substrate for connecting external contacts of the electronic component to contact pads of the substrate after exact positioning.

21. The method according to claim 19, which comprises, before the semiconductor wafer is separated into electronic components, applying the as yet unseparated semiconductor wafer to a side of the film coated with adhesive and thereby aligning rows and columns of the electronic components with rows and columns of the passage openings of the perforated film.

22. The method according to claim 19, which comprises, after the semiconductor wafer has been separated into electronic components, clamping the film with the electronic components into the wafer holding frame.

23. The method according to claim 19, which comprises, before the wafer holding frame is supplied into the wafer holding device of the placement system, carrying out a functional test of each electronic component and marking non-functioning electronic components as such.

24. The method according to claim 19, wherein each electronic component is provided with markings for positioning in the placement system and for detection by the component position identification device during a placement operation, for enabling a correct positioning of each component.

25. The method according to claim 19, wherein the substrate is a ceramic plate populated with uncovered contact pads on a top side thereof.

26. The method according to claim 19, wherein the substrate is a printed circuit board populated with uncovered contact pads on a top side thereof.



27. The method according to claim 19, wherein the substrate is a multilayer printed circuit board or multilayer ceramic plate populated with uncovered contact pads on a top side thereof.